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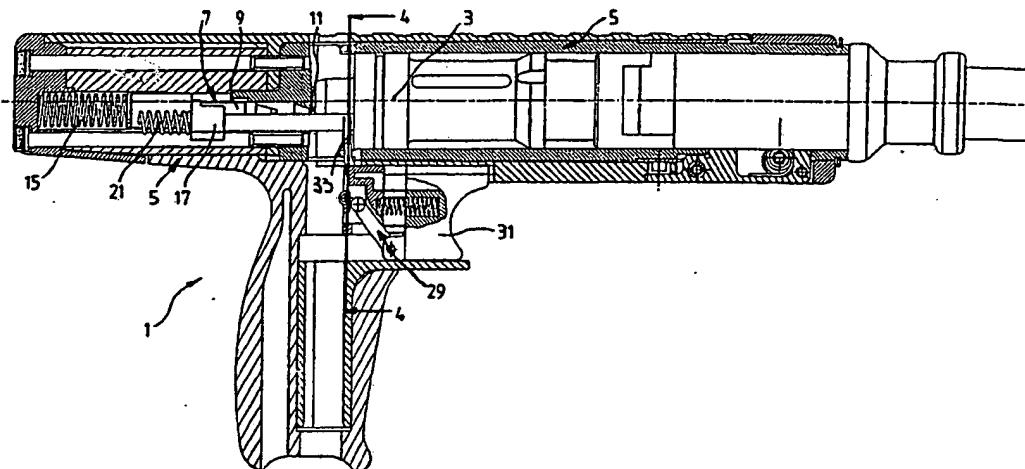
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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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| (71) Applicant (for all designated States except US): RAMSET FASTENERS (AUST.) PTY. LIMITED [AU/AU]; Maroondah Highway, Croydon North, VIC 3136 (AU). |    | Published<br>With international search report   |
| (72) Inventor; and  |    |   |
| (75) Inventor/Applicant (for US only): LOGAN, Alan [AU/AU]; 8 Bellavista Place, North Ringwood, VIC 3134 (AU).  |    |   |
| (74) Agents: HIND, Raymond, Stenton et al.; Davies & Collison, 1 Little Collins Street, Melbourne, VIC 3000 (AU).                                     |    |   |

(54) Title: POWER ACTUATED FASTENER TOOL



(57) Abstract

A power actuated tool for driving a fastener into a work surface includes a firing pin (9) for firing an explosive charge to drive the fastener. The firing pin (9) is held in a cocked position against a spring bias by a rotary sear (17) which is displaced rearwardly during cocking by pressing a barrel (21) against the work surface. In the cocked condition, the sear (17) is aligned with a

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POWER ACTUATED FASTENER TOOL

The present invention relates to power actuated fastener tools.

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Power actuated tools for driving a fastener such as a nail, into a substrate, such as a concrete beam, conventionally comprise a barrel from which the fastener is expelled by means of a piston driven by 10 detonation of an explosive charge. The charge is fired by release of a firing pin after cocking of the tool. In conventional firing mechanisms the firing pin has a slot of sufficient depth to allow a pawl to be contained within the slot. A spring inside the 15 slot biases the pawl to project out of the slot to engage with, and be retained by, a cocking piece. To cock the tool, the forward end of the barrel is pressed hard against the work surface and this results in the rear face of the barrel pushing 20 against the cocking piece which retracts the firing pin against the bias of a firing pin spring. When the firing pin is in the cocked position, a sear which is connected to the trigger is aligned with the

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pawl. When the trigger is actuated, the sear retracts the pawl into the firing pin, thus releasing the firing pin from the cocking piece whereby the firing pin is driven by the firing pin spring towards 5 the explosive charge to fire the power actuated tool.

The firing pin is of relatively small diameter and the space available for mounting the pawl within the firing pin is limited. For the tool 10 to perform consistently the fit between the pawl and the slot in the firing pin must be maintained. It has been found that repeated firing results in the pawl wearing against both the cocking piece and the slot wall. This results in the pawl becoming loose 15 within the cocking piece and firing pin.

Consequently when the sear applies the upward force upon actuation of the trigger, instead of driving the pawl upward into the slot of the firing pin, the pawl may twist and jam. Thus a greater release force is 20 required which makes actuation of the trigger increasingly difficult. It has also been known for a pawl to jam and then to suddenly, and unexpectedly, release, thus firing the tool, which can be very dangerous.

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According to the present invention, there is provided a power actuated tool for driving a fastener into a substrate, comprising a firing mechanism including a firing pin for firing an explosive charge 30 to drive the fastener from a barrel of the tool, spring means for driving the firing pin, and a rotary sear pivotal between a position in which the sear engages an abutment surface of the pin whereby to entrain the pin and a released position in which the

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sear is released from the abutment surface whereby to permit driving of the firing pin towards the charge under the bias of the spring means.

5 An embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:-

Figure 1 is a sectional view of a power actuated tool fitted with a firing mechanism in accordance with the present invention, the tool being shown in its cocked condition.

15 Figure 2 is a fragmentary schematic view of a firing pin, rotary sear and trigger sear plate in the cocked condition;

Figure 3 is a view similar to Figure 2, but 20 after firing;

Figure 4 is a fragmentary schematic view on line 4-4 of Figure 1 and showing the firing pin, rotary sear, and sear plate in the cocked position; 25 and

Figure 5 is a view similar to Figure 4, but after firing.

30 The power actuated tool 1 comprises a barrel 3 mounted in a receiver assembly 5, and a firing mechanism 7 having a firing pin 9 mounted in the receiver assembly rearwardly of the barrel 3. The barrel 3 houses a piston (not shown) which is

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actuated by an explosive charge mounted in a charge chamber 11 at the rear of the barrel 3, to drive a fastener within the forward end of the barrel 3 into a substrate such as a beam. The barrel 3 is mounted 5 for axial movement within the receiver assembly 5 and after firing can be moved forwardly of the receiver assembly 5 in order to reset the piston into the rear end of the barrel 3 in preparation for the next firing. Prior to the next firing, a fresh charge is 10 inserted into the charge chamber 11 (either manually or automatically) and the barrel 3 together with the piston is withdrawn into the receiver assembly 5. In order to fire the tool, the forward end of the barrel 3 is pressed against the work surface which has the 15 effect of moving the barrel 3 back further into the receiver assembly 5 which causes cocking of the firing mechanism 7.

The firing pin 9 of the firing mechanism 7 20 is stepped to provide a forwardly facing abutment face 13. The firing pin 9 is biased in an axially forwards direction by means of a compression spring 15. The firing pin 9 is associated with a rotary sear 17 which is mounted to one side of the firing 25 pin 9 for rectilinear movement parallel to the axis of the firing pin 9 and also for rotation about the axis of rectilinear movement. The sear 17 comprises, at its rear end, a radial lug 19 which co-operates with the firing pin 9 to hold the pin 9 in its cocked 30 position, as will be described. A compression spring 21 acts to apply an axially forwards bias to the rotary sear 17 and is also fixed to both the receiver assembly 5 and the sear 17 so as to apply a torsional bias to the sear 17 in a sense to pivot the lug 19

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into engagement with the firing pin 9. The rotary sear 17 is fixedly mounted at the rear end of a cocking rod 23 so that the sear 17 and cocking rod 23 are movable as a unit. A radial lug 25 at the 5 forward end of the cocking rod 23 co-acts with a sear plate 27 of a trigger mechanism 29 in the cocked position, as will be described. The trigger mechanism 29 includes a trigger 31.

10 In the condition in which the barrel 3 has been withdrawn into the receiver assembly 5 after re-setting of the piston and prior to cocking, the rotary sear 17 is forwardly of the abutment face 13 of the firing pin 9 with the lug 19 being biased 15 towards the firing pin 9 by the torsional bias of the spring 21. The lug 25 at the forward end of the cocking rod 23 is also forwardly of the trigger sear plate 27 in this condition. Upon pushing the forward end of the barrel 3 against the work surface in order 20 to cock the tool, the barrel 3 moves back further into the receiver assembly 5. A stepped abutment surface 33 at the rear end of the barrel 3 engages the forward end of the cocking rod 23 and causes the cocking rod and rotary sear 17 to be displaced 25 rearwardly with the barrel 3 against the bias of the spring 21. During this movement, the lug 19 on the rotary sear 17 engages the forward abutment face 13 on the firing pin 9 and causes retraction of the firing pin 9 against the bias of the compression 30 spring 15. When the barrel 3 is retracted to its maximum extent within the receiver assembly 5, the rear end of the barrel 3 including the charge chamber 11 is firmly against the forward face of the rear part of the receiver assembly 5 housing the firing

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mechanism 7, and the lug 25 at the forward end of the cocking rod 23 is aligned with the sear plate 27 of the trigger 31. Actuation of the trigger 31 causes linear displacement of the sear plate 27 which 5 engages the lug 25 and pivots the lug 25 and thus the cocking rod 23 and rotary sear 17 in a sense to move the lug 19 angularly away from the firing pin 9, to thereby release the firing pin 9 which is then driven against the charge in the charge chamber 11 under the 10 bias of the compression spring 15.

After firing, the barrel 3 is moved forwardly to reset the piston. The forwards movement of the barrel 3 permits the rotary sear 17 and 15 cocking rod 23 to move forwardly under the bias of the spring 21 whereby the lug 19 on the rotary sear 17 moves along the larger diameter rear portion 37 of the firing pin 9 until it reaches the stepped abutment face 13 at which point the torsional bias of 20 the spring 21 causes the lug 19 to pivot inwardly across the abutment face 13 in preparation for the next firing.

In the embodiment described, to facilitate 25 mounting within the receiver assembly 5, the rotary sear 17 and cocking rod 23 are installed separately and are then locked together to form a unit by means of a connecting pin. In an alternative construction it would, however, be possible to produce the rotary 30 sear 17 and cocking rod 23 as an integral unit which is installed as a whole into the receiver assembly 5. In another alternative construction, the components are installed separately and come into that working relation only during the cocking stroke.

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The firing mechanism 7 described is advantageous because there are no components of the release mechanism within the firing pin 9 so the difficulties of mounting the components within the 5 small diameter firing pin 9 and of maintaining the fit between the firing pin 9 and release components are avoided. The firing mechanism 7 also provides a very smooth firing action. This is due to the relatively small angle of rotation of the rotary sear 10 17. The rotation is typically 20° during the firing operation and this results in only a small increase in the torsional force component of the compression spring 21. Accordingly a much smoother searing action is provided. The compression spring 21 is 15 relatively long so that it can easily handle this small degree of rotation without jamming.

In addition the firing mechanism 7 is wear-compensating as any wear of the lug 19 against 20 the stepped abutment face 13 will automatically be taken up by the spring bias applied to the firing pin 9 by the firing pin spring.

The embodiment has been described by way of example 25 only and modifications are possible within the scope of the invention.

CLAIMS

1. A power actuated tool for driving a fastener into a substrate, comprising a firing mechanism including a firing pin for firing an explosive charge to drive the fastener from a barrel of the tool, spring means for driving the firing pin, and a rotary sear pivotal between a position in which the sear engages an abutment surface of the pin whereby to entrain the pin and a released position in which the sear is released from the abutment surface whereby to permit driving of the firing pin towards the charge under the bias of the spring means.
2. A tool according to claim 1, wherein the sear is pivotal about an axis parallel to the axis of the driving pin.
3. A tool according to claim 1 or claim 2, wherein the sear is movable in a direction parallel to the axis of the firing pin so as to entrain the pin by engagement with the abutment surface in order to cock the firing mechanism.
4. A tool according to claim 3, wherein the barrel is displaceable within a body of the tool, and cocking of the firing mechanism is effected by pressing the front of the barrel against a work surface to displace the barrel rearwardly, the sear being displaced rearwardly by the rearwards displacement of the barrel to thereby cause rearwards displacement of the firing pin against the bias of the spring means with the pin being entrained by the sear.

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5. A tool according to claim 4, wherein in the cocked condition of the firing mechanism, the sear is aligned with a trigger mechanism such that actuation of the trigger mechanism pivots the sear into its released position.

6. A tool according to claim 5, wherein the trigger mechanism includes a sear plate and the sear includes a projection which moves into alignment with the sear plate when the sear is moved rearwardly on cocking, actuation of a trigger of the trigger mechanism causing engagement of the sear plate with the projection to pivot the sear into its released position upon actuation of the trigger effecting pivotal movement of the sear.

7. A tool according to any one of the preceding claims, comprising torsion spring means biasing the sear into its engaged position.

8. A tool according to claim 7, wherein the torsion spring means comprises a compression spring which applies a torsional bias to the sear and also applies a forwards axial bias to the sear.

9. A tool according to any one of the preceding claims, wherein the sear includes a lug extending radially of the pivotal axis of the sear to engage the abutment surface of the firing pin.

10. A tool according to any one of the preceding claims, wherein the abutment surface of the firing pin is defined by a forward face formed on a step in the firing pin.

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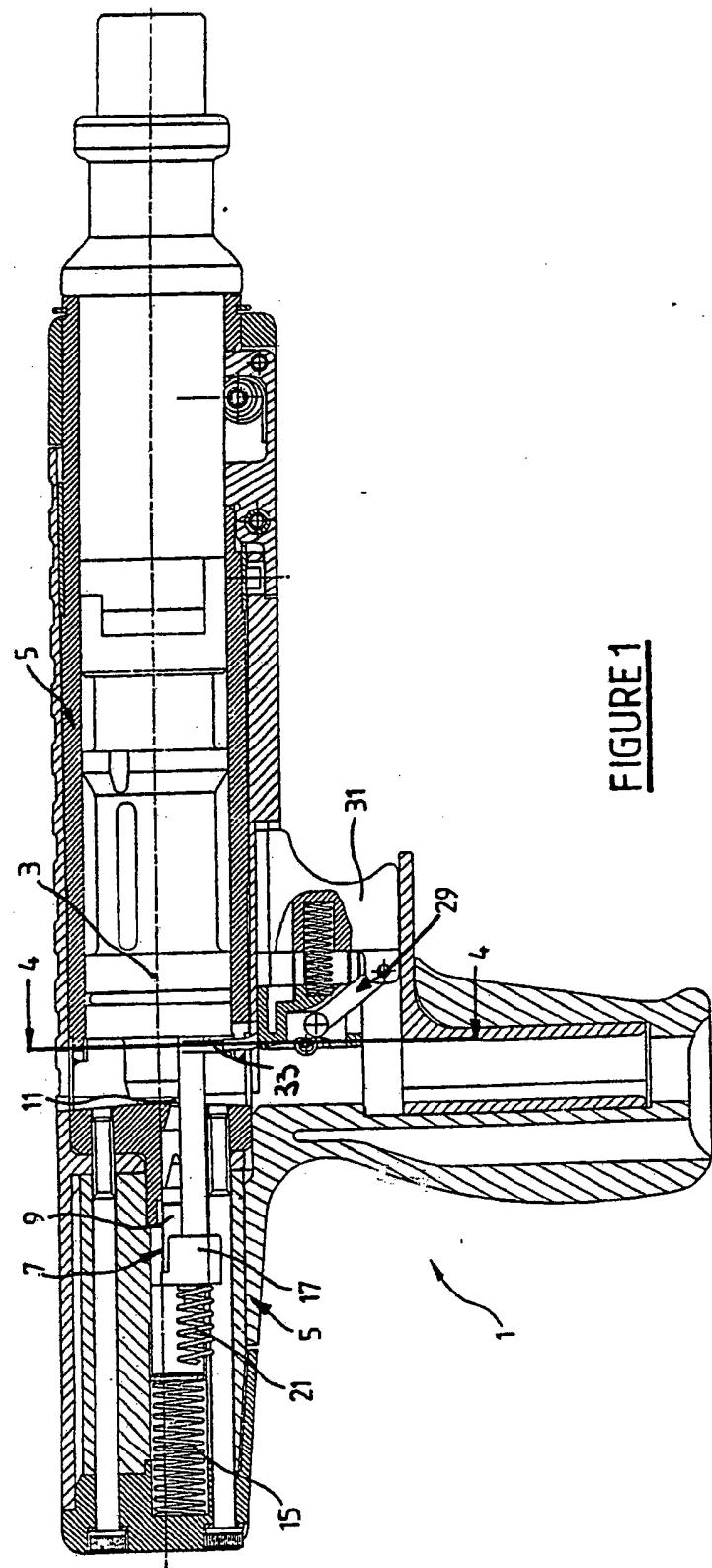


FIGURE 1

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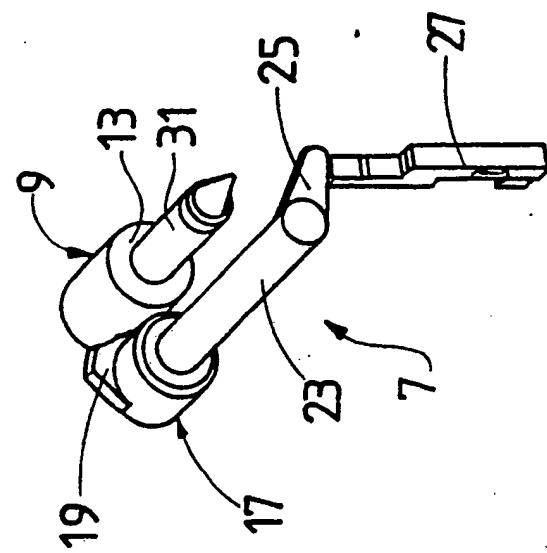


FIG. 3

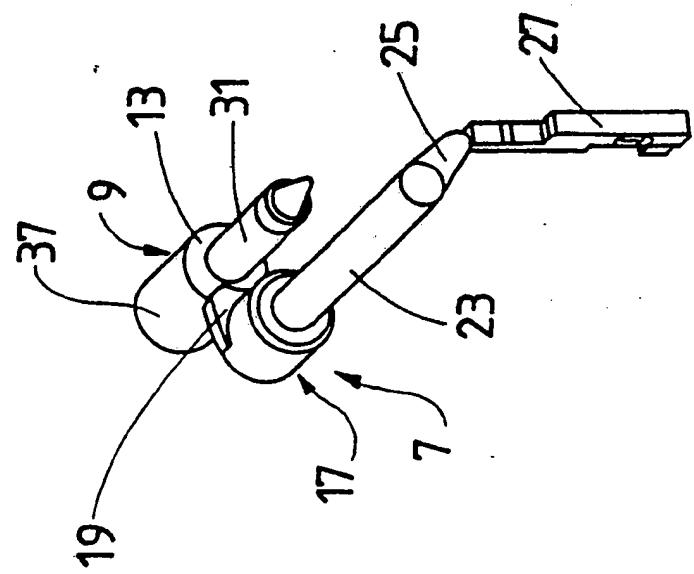
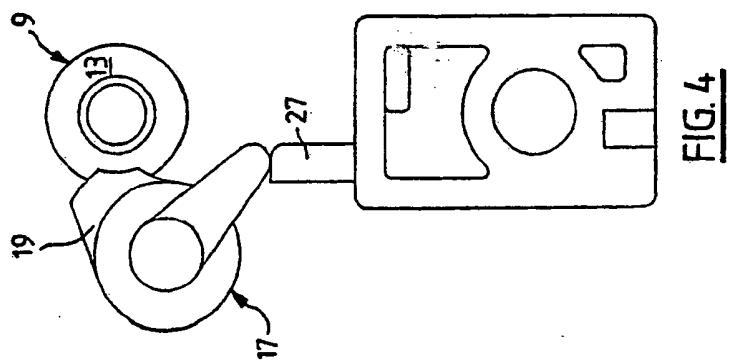
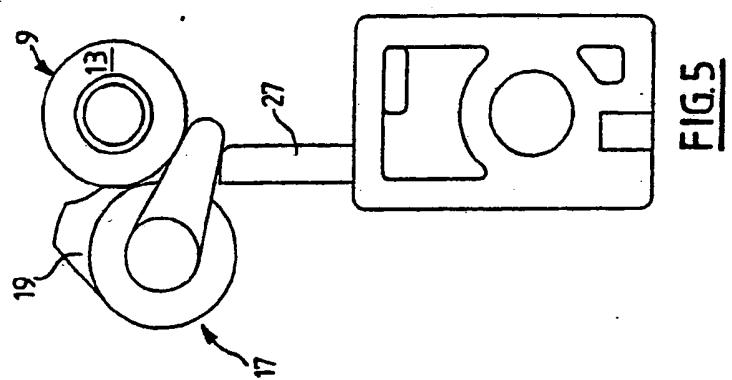


FIG. 2

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## INTERNATIONAL SEARCH REPORT

International Application No. PCT/AU 90/00018

## I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) 6

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl. <sup>5</sup> B25C 1/14, 1/18; F41A 19/29,

## II. FIELDS SEARCHED

## Minimum Documentation Searched 7

| Classification System | Classification Symbols             |
|-----------------------|------------------------------------|
| I.P.C.                | B25C 1/14, 1/18; F41C 19/14, 19/16 |

Documentation Searched other than Minimum Documentation  
to the Extent that such Documents are Included in the Fields Searched 8

AU: IPC as above

## III. DOCUMENTS CONSIDERED TO BE RELEVANT 9

| Category* | Citation of Document, <sup>11</sup> with indication, where appropriate,<br>of the relevant passages 12 | Relevant to<br>Claim No 13 |
|-----------|--|----------------------------|
| X         | GB,A, 892960 (JUREK) 4 April 1962 (04.04.62)   | 1                          |
| X         | GB,A, 956726 (SARMI S.A.) 29 April 1964 (29.04.64)   | 1                          |
| X         | GB,A, 2081429 (THE SECRETARY OF STATE FOR DEFENCE) 17 February 1982<br>(17.02.82)                      | 1                          |
| X         | FR,A, 599153 (LAMBINON) 6 January 1926 (06.01.26)  | 1                          |
| X         | FR,A, 836859 (ELISEI) 27 January 1939 (27.01.39)   | 1                          |
| X         | DE,A, 810947 (KRIEGER SKORTEZ CO GmbH) 16 August 1951 (16.08.51)                                       | 1, 10                      |
| X         | CH,A, 242371 (BRNO) 1 October 1946 (01.10.46)  | 1                          |

(continued)

|   |   |
|---|---|
| * Special categories of cited documents: 10   | "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention   |
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## IV. CERTIFICATION

|   |  |
|---|--|
| Date of the Actual Completion of the International Search<br>20 April 1990 (20.04.90) | Date of Mailing of this International Search Report<br>30 April 1990 |
| International Searching Authority<br>Australian Patent Office                         | Signature of Authorized Officer<br>D.G. FRY <i>D.G.F. Jm</i>         |
|   | D.G. FRY   |

## FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

|   |   |       |
|---|---|-------|
| X | CH,A, 344643 (KONSTRUKTA PRAHA) 31 March 1960 (31.03.60)        | I     |
| X | CH,A, 348078 (HAMMERLI AG) 15 September 1960 (15.09.60)         | I     |
| X | CH,A, 494386 (HECKLER & KOCH GmbH) 15 September 1970 (15.09.70) | I, 10 |

## V. [ ] OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE 1

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. [ ] Claim numbers ..., because they relate to subject matter not required to be searched by this Authority, namely:

2. [ ] Claim numbers ..., because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. [ ] Claim numbers ..., because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4 (a):

## VI. [ ] OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING 2

This International Searching Authority found multiple inventions in this international application as follows:

1. [ ] As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. [ ] As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. [ ] No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. [ ] As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

## Remark on Protest

[ ] The additional search fees were accompanied by applicant's protest.  
 [ ] No protest accompanied the payment of additional search fees.

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON  
INTERNATIONAL APPLICATION NO. PCT/AU 90/00018

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

| Patent Document<br>Cited in Search<br>Report |         | Patent Family Members |          |    |         |    |         |
|--|---------|-----------------------|----------|----|---------|----|---------|
| GB   | 2081429 | AU                    | 73734/81 | BR | 8108699 | EP | 44632   |
|  |         | ES                    | 503898   | IL | 63263   | IN | 157162  |
|  |         | NO                    | 820809   | US | 4471549 | WO | 8200345 |
|  |         | ZA                    | 8104544  |    |         |    |         |
| CH   | 494386  | BE                    | 739037   | DE | 1728249 | ES | 371597  |
|  |         | FR                    | 2018332  | GB | 1281041 | IL | 33018   |
|  |         | US                    | 3641694  |    |         |    |         |

END OF ANNEX

